PolyGard® DT5-1112

Electrochemical Carbon Monoxide Transmitter
Serial No. DT5-1112

User Manual

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Electrochemical Carbon Monoxide Transmitter

1 General Overview

The PolyGard® CO analog gas transmitter DT5-1112 with digital processing of the measuring values and temperature compensation is used for the continuous monitoring of the ambient air to detect the presence of carbon monoxide gas. Main application ranges are underground car parks, tunnels, engine test stations, shelters, loading areas etc.

The intended sites are all areas being directly connected to the public low voltage supply, e.g. residential, commercial and industrial ranges as well as small enterprises.

The PolyGard® CO analog transmitter must not be used in potentially explosive atmospheres.

2 Functional Description

2.1 Control Mode

The transmitter can be connected to the PolyGard® DGC5 system via the RS-485 interface. In this mode there is an analog input for the connection of an additional 4-20 mA transmitter. The two measuring values are transmitted via the RS-485 interface to the gas controller.

The cable topology for the RS-485 bus can be taken from the “Guidelines for wiring and commissioning of the DGC5 hardware”.

2.2 Sensor

The sensor portion of the transmitter is a sealed electro-chemical cell with two electrodes, sensing and reference (type DT5-1112). The ambient air to be monitored diffuses through a membrane filter into the liquid electrolyte of the sensor. The chemical process of the measurement is one of oxidation where one molecule of the target gas is exchanged for one molecule of oxygen. The reaction drives the oxygen molecule to the counter electrode, generating a DC microampere signal between the sensing and reference electrodes. This signal is linear to the volume concentration of the sensed gas. The signal is evaluated by the connected amplifier and transformed into a linear output signal.

Electrochemical processes always lead by-and-by to a loss of sensitivity. Therefore regular calibration of zero-point and gain is necessary. See paragraph 6.

Caution:

There is a small quantity of corrosive liquid in the sensor element. If in case of damage persons or objects touch the liquid, you have to clean the affected areas as fast and carefully as possible with tap water. Out of use sensors must be disposed in the same way as batteries.

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3 Installation

Note: Avoid any force (e.g. by thumb) on the sensor element during operation or installation. Electronics can be destroyed by static electricity. Therefore, do not touch the equipment without a wrist strap connected to ground or without standing on a conductive floor.

3.1 Mounting Instructions

When choosing the mounting site please pay attention to the following:

- The specific weight of carbon monoxide is a smaller than that of air (factor 0.97). Recommended mounting height is 1.5 m (5 feet) to 1.8 m (6 feet) above floor.
- Choose mounting location of the sensor according to the local regulations.
- Consider the ventilation conditions! Do not mount the transmitter in the center of the airflow (air passages, suction holes).
- Mount the transmitter at a location with minimum vibration and minimum variation in temperature (avoid direct sunlight).
- Avoid locations where water, oil etc. may influence proper operation and where mechanical damage might be possible.
- Provide adequate space around the sensor for maintenance and calibration work.

Duct mounting

- Mount only in a straight section of duct with minimum air vortex. Keep a minimum distance of 1 m (3.5 feet) from any curve or obstacle.
- Mount only in a duct system with a maximum air velocity of 10 m/s (2000 ft/min) or less.
- Mounting must be performed so that the probe openings are in line with the airflow.

3.2 Installation

- Open the cover. Unplug basic PCB carefully from the bottom part.
- Fix bottom part by screws vertically to the wall (terminal blocks to the ground).
- Plug in the basic PCB at X4 and X5 with care. Replace the cover.

4 Electrical Connection

Consider static electricity! See 3. Mounting

- Installation of the electrical wiring should only be performed by a trained specialist according to the connection diagram, without any power applied to conductors and according to the corresponding regulations!
- Avoid any influence of external interference by using shielded cables for the signal line, but do not connect the shield.
- Required cable for RS-485 mode: 0.8 AWG shielded twisted cable.
- It is important to ensure that the wire shields or any bare wires do not short the mounted PCB.

4.1 Wiring Connection

- Open the cover. Unplug basic PCB carefully from terminal blocks at X4 and X5.
- Insert the cable; connect cable leads to terminal blocks. See fig. 1 and 2.
- Replug the PCB in the terminal blocks X4, X5. Replace cover.

Note. A Connection of Power supply at the Output signal (X4 Pin 4) will destroy the Transmitter.

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5 Commissioning

Consider commissioning instructions at any exchange of sensor elements.

Only trained technicians should perform the following:

- Check mounting location.
- Select output signal form: Current or voltage, and starting point 0 or 20%. See fig. 4.
- Check power voltage.
- Check PCB DT5-1112 for proper mounting at X4 and X5.
- Addressing of the transmitter in the DGC5_Bus mode.
- Calibrate the transmitter (if not already factory-calibrated).

Required instruments for commissioning (calibration) of the transmitter:

- Test gas bottle with synthetic air of CO-free ambient air.
- Test gas bottle with CO (ppm) in the range of 30 – 80 % of the measuring range.
- Gas pressure regulator with flow meter to control the gas flow to 150 ml/min.
- Calibration adapter with tube, depending on the transmitter type.
  DT5-1112 = Calibration set CONKIT-E/CH-LC. See fig. 5.
- Digital voltmeter with range 0 – 300mV, accuracy 1% and a small screwdriver.
- DGC5 configuration and calibration software incl. USB/RS-485 communication set (only for software calibration mode).

Note:

Prior to calibration the sensor element must be fully stabilized by applying power voltage for at least 1 hour without interruption.

Please observe proper handling procedures for test gas bottles!

Attention: CO calibration gas is toxic, never inhale the gas!
Symptoms: Dizziness, headache and nausea.
Procedure if exposed: Take the victim into fresh air at once, call a doctor.

5.1 Calibration

Depending on the version and the control mode there are two different possibilities to calibrate the transmitter:

Manual calibration

Manual calibration is only possible if the transmitter is equipped with the push-button “Zero” and the potentiometer “Gain” (= version for manual calibration).

In the DGC5_Bus mode the jumper V-A has to be set before manual calibration. Only by doing so the control voltage is available at the test pins X6. Remove the jumper after calibration.

Software calibration via PC

In the standard version (equipped with the communication connector X12) calibration can also be done by means of the configuration and calibration software.

Software calibration is possible for both control modes.

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5.2 Manual Calibration

5.2.1 Zero-point

- Connect calibration adapter carefully to the sensor element.
- Apply synthetic air (150 ml/min; 1 Bar (14.5 psi) ± 10%), or CO-free ambient air.
- Wait 2 minutes until the signal is stable, push button “Zero” for 5 seconds.

  After successful calibration the measuring signal is corrected automatically. Depending on the selected signal starting point the measuring signal shows the following values:

  Signal start at 2 V or 4 mA 40 mV = 0 ppm
  Signal start at 0 V or 0 mA 0 mV = 0 ppm

  If the zero-point is out of the admissible range (> 20 mV at starting point 0% / > 60 mV at starting point (20%) before calibration, there is no correction of the measuring signal. The sensor has to be replaced.
- Remove calibration adapter carefully by turning lightly. Check the sensor for correct mounting!

5.2.2 Gain

- Connect calibration adapter carefully to the sensor element.
- Apply calibration test gas CO (150 ml/min; 1 Bar (14.5 psi) ± 10%).
- Wait two minutes until the signal is stable, adjust control voltage with potentiometer ”Gain” until the signal corresponds to the calculated value ± 3 mV
- Remove calibration adapter with a careful light turn. Check the sensor for correct mounting!

  By limiting the gain factor, calibration will not be possible any more when the sensitivity of the sensor reaches a residual sensitivity of 30 %. Then the sensor has to be replaced.

5.2.3 Calculation of Control Voltage

Signal start 2 V / 4 mA

$$\text{Control voltage (mV)} = \frac{160\ (\text{mV}) \times \text{test gas concentration CO (ppm)}}{\text{measuring range CO (ppm)}} + 40\ (\text{mV})$$

Signal start 0 V / 0 mA

$$\text{Control voltage (mV)} = \frac{200\ (\text{mV}) \times \text{test gas concentration CO (ppm)}}{\text{measuring range CO (ppm)}}$$

Example:

Measuring range	250 ppm
Test gas concentration	200 ppm CO
Control voltage: Signal start 2 V / 4 mA	168 mV
Control voltage: Signal start 0 V / 0 mA	200 mV

Signal start 2 V / 4 mA

$$\frac{160\ (\text{mV}) \times 200\ (\text{ppm})}{250\ (\text{ppm})} + 40\ (\text{mV}) = 168\ \text{mV}$$

Signal start 0 V / 0 mA

$$\frac{200\ (\text{mV}) \times 200\ (\text{ppm})}{250\ (\text{ppm})} = 200\ \text{mV}$$

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5.3 Calibration with DGC5 Configuration and Calibration Software

- Connect the PC via USB/RS-485 communication set to the transmitter, open menu “Calibration”.
- Enter measuring range and test gas concentration.
- Connect calibration adapter carefully to the sensor element
- Apply synthetic air (150 ml/min; 1 Bar (14.5 psi) ± 10%), or CO -free ambient air.
- Wait until the measuring value is stable, and then perform automatic zero calibration.
- Apply calibration test gas CO (150 ml/min; 1 Bar (14.5 psi) ± 10%).
- Wait until the measuring value is stable, and then perform automatic gain calibration.
- Remove calibration adapter carefully by turning lightly. Check the sensor for correct mounting!

  By limiting the gain factor, calibration will not be possible any more when the sensitivity of the sensor reaches a residual sensitivity of 30 %. In this case the sensor has to be replaced.

Further information can be taken from the user manual of the DGC5 Configuration and Calibration Software.

5.4 Addressing

In the DGC5_Bus mode each transmitter gets its communication address.

In the standard version with the communication connector X12, addressing is done by means of the DGC5 Configuration and Calibration Software. See user manual of the Configuration and Calibration Software.

5.5 Option Relay Output

The two relays are activated in dependence of the gas concentration. If the gas concentration exceeds the adjusted alarm threshold, the corresponding relay switches on. If the gas concentration falls below the threshold minus hysteresis, the relay switches off again.

The contact function for relay 2, NC (normally closed) or NO (normally open), can be selected via the jumper NO/NC. See fig 1 and 3. Relay 1 is equipped with a change-over contact.

Via the ModBus interface the two alarm thresholds and the hysteresis are freely adjustable at the PC within the measuring range. The procedure can be read from the user manual “ModBus Software”.

The following parameters are factory-set.

Alarm threshold 1 = Relay 1: 40 ppm
Alarm threshold 2 = Relay 2: 80 ppm
Switching hysteresis: 15 ppm

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6 Inspection and Service

6.1 Inspections

Inspection, service and calibration of the transmitters should be done by trained technicians and executed at regular intervals. We therefore recommend concluding a service contract with one of our authorized partners.

6.2 Calibration

(See section 5.1 and 5.2)

- At commissioning and at periodic intervals determined by the person responsible for the gas detection system (recommendation every 12 months).
- After exchange of the sensor
- If in case of operational or climatic influences the sensitivity of the sensor falls below 70% in operation, calibration will not be possible any more. Then the sensor has to be changed.

6.3 Exchange of Sensor Element

Consider static electricity! See point 3.

Sensor should always be installed without power applied:

- Unplug basic PCB DT-1112 carefully from the bottom part.
- Unplug old sensor from the PCB.
- Take the new sensor out of the original packing.
- Plug in the sensor element into the PCB
- Replug the PCB DT-1112 into terminal blocks X4, X5 carefully.
- Calibrate according to section 5.

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7 Troubleshooting

7.1 DGC5_Bus Mode

Trouble	Cause	Solution
Yellow LED not shining	Power voltage not applied	Measure voltage at X4: Pin 1 (+) and 2 (–)
	PCB not plugged in correctly at X4/X5	Replug PCB correctly
	Wire break	Check wiring
Yellow LED not flashing	No communication at the transmitter	Transmitter not addressed, check bus wiring incl. topology and termination Voltage < 16 V
No control voltage at calibration	Jumper V-A not set	Set the jumper. Remove it after calibration!

8 Cross-sensitivity Data

The cross-sensitivity depends on the used transmitter type and can be read from the table Technical Data (see 9.). Other gases can have an influence on the sensitivity, too. The table does not claim to be complete. The indicated sensitivity data are only standard values referring to new sensor elements.

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9 Technical Data

General sensor performances		
Gas type	Carbon monoxide (CO)	
Sensor element	Electrochemical, diffusion	
Measuring range (standard; other ranges according to the data sheet)	0 - 300 ppm (ex works) adjustable between 0-150 and 0-300 ppm	
Pressure range	Atmosphere ± 15 %	
Humidity	15 – 90 % RH non condensing	
Storage temperature range	5 °C to 20 °C (41 °F to 64 °F)	
Storage time	Max. 6 months	
Mounting height	1.5 to 1.8 m (5 to 6 ft.)	
Type DT5-1112		
Accuracy	± 3 ppm	
Repeatability	± 3 % of reading	
Long-term output drift	< 5% signal loss/year	
Response time	t_{90} < 50 sec.	
Life expectancy	> 5 years/normal operating environment	
Humidity range – short-term	0 – 95 % RH non condensing	
Temperature range - continuous	-10 °C to + 50 °C (14 °F to 122 °F)	
Temperature range – short-term	-20 °C to + 50 °C (-4 °F to 122 °F)	
Cross sensitivity*	Concentration (ppm)	Reaction (ppm CO)
Acetone, C_3H_6O	1000	0
Acetylene, C_2H_2	40	80
Ammonia, NH_3	100	0
Chlorine, Cl_2	2	0
Ethanol, C_2H_5OH	2000	5
Iso Propanol, C_3H_8O	200	0
Carbon dioxide, CO_2	5000	0
Nitrogen dioxide, NO_2	50	-1.0
Nitric oxide, NO	50	8
Sulphur dioxide, SO_2	50	< 0.5
Hydrogen Sulphide, H_2S	25	0
Hydrogen, H_2	100	20
Electrical		
Power supply	18 - 28 VDC/AC, reverse polarity protected 2-wire mode: Only VDC	
Power consumption (without options)	10 mA, max. (0.3 VA)	

* The table doesn't claim to be complete. Other gases, too, can have an influence on the sensitivity. The mentioned cross-sensitivity data are only reference values valid for new sensors.

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Output signal	
Analog output signal Selectable: Current / tension Starting point 0 / 20 %	(0) 4 – 20 mA, load ≤ 500 Ω, (0) 2 – 10 V; load ≥ 50 k Ω proportional, overload and short-circuit proof
Serial interface	
Transceiver	RS 485 / 19200 Baud
Protocol	MSR_DT05
Physical	
Enclosure*	Stainless steel V2A
Enclosure colour*	Natural, brushed
Dimensions* (H x W x D)	113 x 135 x 45 mm / (5.35 x 4.5 x 1.8 in.)
Weight*	Approx. 0.5 kg (1.1 lbs.)
Protection class*	IP 55
Mounting*	Wall mounting, pillar mounting
Cable entry	Standard 1 x M 20
Wire connection	Screw-type terminal min. 0.25 to 2.5 mm^2 24 to 14 AWG
Wire distance	Current signal ca. 500 m (1500 ft.) Voltage signal ca. 200 m (500 ft.)
Guidelines	EMC Directive 89/336/EEC
	CE

Options	
Relay output	
Alarm relay 1	30 VAC/DC 0.5 A, potential-free, SPDT
Alarm relay 2	30 VAC/DC 0.5 A, potential-free SPNO/SPNC
Power consumption	30 mA, (max. 0.8 VA)
Warning buzzer	
Acoustic pressure	85 dB (distance 300 mm) (1 ft.)
Frequency	3.5 kHz
Power consumption	30 mA, (max. 0.8 VA)
LCD-Display	
LCD	Two lines, 16 characters each, not illuminated
Power consumption	10 mA, (max. 0.3 VA)
Heating	
Temperature controlled	3 °C ±2°C (37.5 °F ± 35.5 °F)
Ambient temperature	- 40 °C (-40 °F)
Power supply	18 - 28 VDC/AC
Power consumption	0.5 A; 12 VA
Analog input	
Only for RS-485 mode	4 – 20 mA overload and short-circuit proof, input resistance 200 Ω

* Indications only for "stainless steel" option; for further types see AT-DT Enclosure datasheet.

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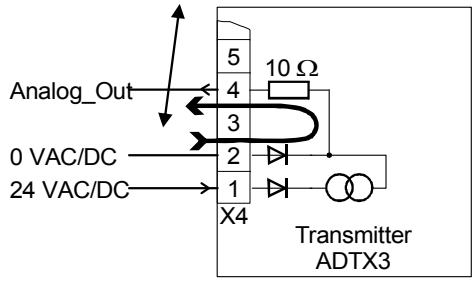
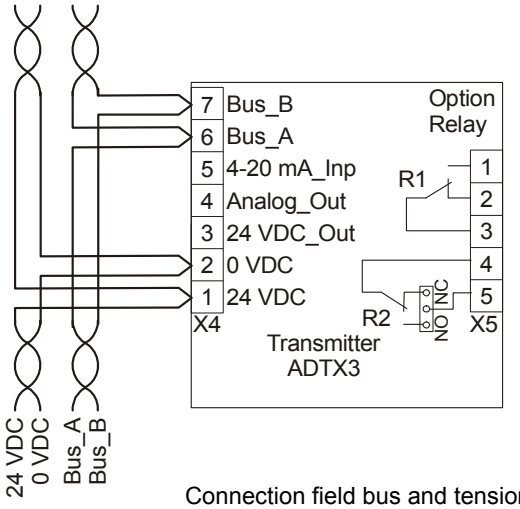
10 Figures

Application: Analog mode
Fig. 1

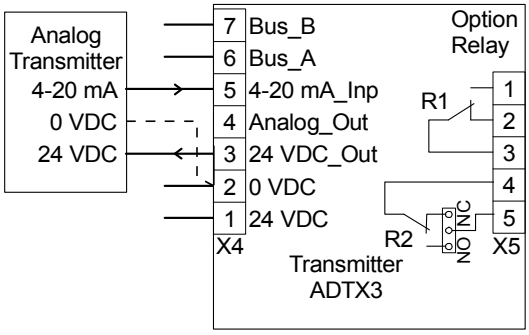
Do not connecting 24 VAC at Pin 2 and Pin 4
or +24 VDC at Pin 2 and 0 VDC at Pin 4!!
Short-circuit = R 10 Ohm burns up!!



Application: DGC5_Bus mode
Fig. 2



Connection field bus and tension



Connection analog transmitter
- Two- or three-wire connection

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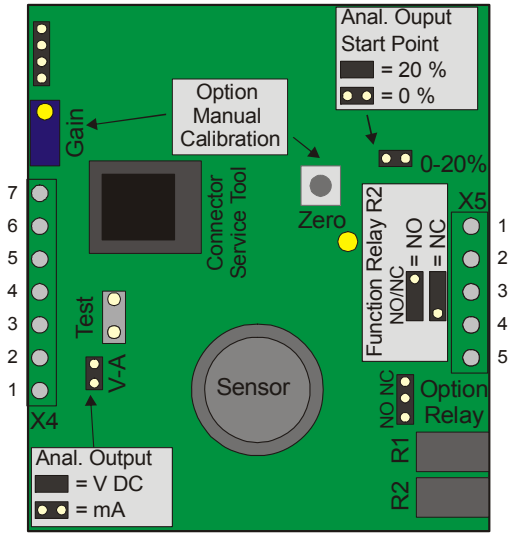
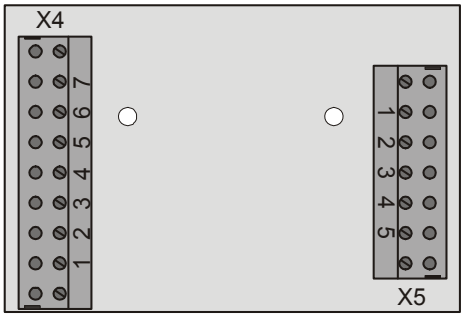
PCB DT5-1112
Fig. 3

Type DT5-1112



Terminal block



Selection analog output signal
Fig. 4

Jumper 0- 20 %	Jumper V-A	Output signal
Not set	Not set	0 – 20 mA
Set	Not set	4 – 20 mA
Not set	Set	0 – 10 V
Set	Set	2 – 10 V

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Calibration adapter
Fig. 5
Type: CONKIT-E/CH-LC

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11 Notes and General Information

It is important to read this user manual thoroughly and clearly in order to understand the information and instructions. The PolyGard® transmitters must be used within product specification capabilities. The appropriate operating and maintenance instructions and recommendations must be followed.

Due to on-going product development, MSR reserves the right to change specifications without notice. The information contained herein is based upon data considered to be accurate. However, no guarantee is expressed or implied regarding the accuracy of this data.

11.1 Intended Product Application

The PolyGard® DT5 transmitters are designed and manufactured for control applications and air quality compliance in commercial buildings and manufacturing plants (i.e. detection and automatic exhaust fan control for automotive maintenance facilities, enclosed parking garages, engine repair shops, warehouses with forklifts, fire stations, tunnels, etc.).

11.2 Installers' Responsibilities

It is the installer's responsibility to ensure that all PolyGard® DT5 transmitters are installed in compliance with all national and local codes and OSHA requirements. Installation should be implemented only by technicians familiar with proper installation techniques, the codes, standards and proper safety procedures for control installations, as well as the latest edition of the National Electrical Code (ANSI/NFPA70). It is also essential to strictly follow all instructions as provided in this user manual.

11.3 Maintenance

It is recommended to performance check the PolyGard® DT5 transmitter regularly. With regular maintenance, any performance deviations may easily be corrected. Re-calibration and part replacement in the field may be implemented by a qualified technician with the appropriate tools. Alternatively, the easily removable plug-in transmitter card with the sensor may be returned for service to IN*TEC* Controls.

11.4 Limited Warranty

MSR-Electronic-GmbH and IN*TEC* Controls warrants the PolyGard® transmitter for a period of two years, 12 months normal exposure for the sensor, from the date of shipment against defects in material or workmanship. Should any evidence of defects in material or workmanship occur during the warranty period, IN*TEC* Controls will repair or replace the product at their own discretion, without charge.

This warranty does not apply to units that have been altered, had attempted repair, or been subject to abuse, accidental or otherwise. The warranty also does not apply to units in which the sensor element has been overexposed or gas poisoned. The above warranty is in lieu of all other express warranties, obligations or liabilities.

This warranty applies only to the PolyGard® transmitter. MSR-Electronic-GmbH and/or IN*TEC* Controls shall not be liable for any incidental or consequential damages arising out of or related to the use of the PolyGard® transmitter.

If the PolyGard® transmitter needs to be returned to IN*TEC* Controls for service, an RMA number must be obtained prior to sending.

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